Calculus 3 *Mathematica* Lab

Work on this lab with a partner. You and your partner will turn in one write-up of the lab by 4PM on Tuesday, 4/26. Your lab should give clear explanations of your process and conclusions. Be sure to edit your session, or use the **PRINT SELECTION** command, to print only the parts you need rather than printing your whole *Mathematica* session.

Problem 1: For functions of one variable, it is impossible for a continuous function to have two local maxima and no local minima. But for functions of two variables, such functions exist. Show that the function

$$f(x,y) = -\left(x^2 - 1\right)^2 - \left(x^2 y - x - 1\right)^2$$

has only two critical points, but has local maxima at both of them. Then produce a graph with a carefuly chosen domain and viewpoint to see how this is possible. Explain how your graph avoids the one variable limitation.

Problem 2: Twenty cubic meters of gravel are to be delivered to a landfill by a trucker. She plans to purchase an open-top box in which to transport the gravel in numerous trips. She figures that the cost to her will be the cost of the box plus $2 per trip. The box must have height 0.5 m, but she can choose the length and width. The cost of the box will be $\$20/m^2$ for the ends and $\$10/m^2$ for the bottom and sides. Notice the tradeoff she faces: A smaller box is cheaper to buy but will require more trips. What size box should she buy to minimize her total costs?

Problem 3: In your text, p 806 #27. You will not be able to find the critical point using NSolve. (Try it and see what happens--you can abort an evaluation under the Evaluation menu.) Instead, you will have to use FindRoot. Use the Help function (? in the upper right corner of the page) to learn how to use FindRoot, and then use it on this example. Also look up NMinimize, and check your answer with that.